

SEQUENCE LISTING

<110> Dehesh, Katayoon

<120> Plant Fatty Acid Synthases and Use in Improved Methods for Production of Medium-Chain Fatty Acids

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<160> 17

<170> PatentIn version 3.1

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<213> Cuphea hookeriana

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Leu Thr Val Phe Ser Asp Gly Val Gln Ser Leu Ile Glu Lys Gly His
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Arg Lys Ile Thr Pro Phe Phe Ile Pro Tyr Ala Ile Thr Asn Met Gly
65 70 75 80

Ser Ala Leu Leu Ala Ile Glu Phe Gly Leu Met Gly Pro Asn Tyr Ser
85 90 95

Ile Ser Thr Ala Cys Ala Thr Ser Asn Tyr Cys Phe His Ala Ala Ala
100 105 110

Asn His Ile Arg Arg Gly Glu Ala Asp Leu Met Ile Ala Gly Gly Thr
115 120 125

Glu Ala Ala Ile Ile Pro Ile Gly Leu Gly Gly Phe Val Ala Cys Arg
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Ala Leu Ser Gln Arg Asn Asp Asp Pro Gln Thr Ala Ser Arg Pro Trp
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Asp Lys Asp Arg Asp Gly Phe Val Met Gly Glu Gly Ala Gly Val Leu
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Val Met Glu Ser Leu Glu His Ala Met Arg Arg Gly Ala Pro Ile Ile
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Ala Glu Tyr Leu Gly Gly Ala Ile Asn Cys Asp Ala Tyr His Met Thr
195 200 205

Asp Pro Arg Ala Asp Gly Leu Gly Val Ser Ser Cys Ile Glu Ser Ser
210 215 220

Leu Glu Asp Ala Gly Val Ser Pro Glu Glu Val Asn Tyr Ile Asn Ala
225 230 235 240

His Ala Thr Ser Thr Leu Ala Gly Asp Leu Ala Glu Ile Asn Ala Ile
245 250 255

Lys Lys Val Phe Lys Asn Thr Lys Asp Ile Lys Ile Asn Ala Thr Lys
260 265 270

Ser Met Ile Gly His Cys Leu Gly Ala Ser Gly Gly Leu Glu Ala Ile
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Ala Thr Ile Lys Gly Ile Asn Thr Gly Trp Leu His Pro Ser Ile Asn
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Gln Phe Asn Pro Glu Pro Ser Val Glu Phe Asp Thr Val Ala Asn Lys
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35 40 45

Tyr Tyr Glu Lys Leu Leu Ser Gly Glu Ser Gly Ile Ser Leu Ile Asp
50 55 60

Arg Phe Asp Ala Ser Lys Phe Pro Thr Arg Phe Gly Gly Gln Ile Arg
65 70 75 80

Gly Phe Asn Ala Thr Gly Tyr Ile Asp Gly Lys Asn Asp Arg Arg Leu
85 90 95

Asp Asp Cys Leu Arg Tyr Cys Ile Val Ala Gly Lys Lys Ala Leu Glu
100 105 110

Asn Ser Asp Leu Gly Gly Glu Ser Leu Ser Lys Ile Asp Lys Glu Arg
115 120 125

Ala Gly Val Leu Val Gly Thr Gly Met Gly Gly Leu Thr Val Phe Ser
130 135 140

Asp Gly Val Gln Asn Leu Ile Glu Lys Gly His Arg Lys Ile Ser Pro
145 150 155 160

Phe Phe Ile Pro Tyr Ala Ile Thr Asn Met Gly Ser Ala Leu Leu Ala
165 170 175

Ile Asp Leu Gly Leu Met Gly Pro Asn Tyr Ser Ile Ser Thr Ala Cys
180 185 190

Ala Thr Ser Asn Tyr Cys Phe Tyr Ala Ala Ala Asn His Ile Arg Arg
195 200 205

Gly Glu Ala Asp Leu Met Ile Ala Gly Gly Thr Glu Ala Ala Ile Ile
210 215 220

Pro Ile Gly Leu Gly Gly Phe Val Ala Cys Arg Ala Leu Ser Gln Arg
225 230 235 240

Asn Asp Asp Pro Gln Thr Ala Ser Arg Pro Trp Asp Lys Asp Arg Asp
245 250 255

Gly Phe Val Met Gly Glu Gly Ala Gly Val Leu Val Met Glu Ser Leu
260 265 270

Glu His Ala Met Lys Arg Gly Ala Pro Ile Ile Ala Glu Tyr Leu Gly
275 280 285

Gly Ala Val Asn Cys Asp Ala Tyr His Met Thr Asp Pro Arg Ala Asp
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Gly Leu Gly Val Ser Ser Cys Ile Glu Ser Ser Leu Glu Asp Ala Gly
305 310 315 320

Val Ser Pro Glu Glu Val Asn Tyr Ile Asn Ala His Ala Thr Ser Thr
325 330 335

Leu Ala Gly Asp Leu Ala Glu Ile Asn Ala Ile Lys Lys Val Phe Lys
340 345 350

Asn Thr Lys Glu Ile Thr Ile Asn Ala Thr Lys Ser Met Ile Gly His
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Cys Leu Gly Ala Ser Gly Gly Leu Glu Ala Ile Ala Thr Ile Lys Gly
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Ile Thr Thr Gly Trp Leu His Pro Ser Ile Asn Gln Phe Asn Pro Glu
385 390 395 400

Pro Ser Val Glu Phe Asp Thr Val Ala Asn Lys Lys Gln Gln His Glu
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Val Val Ala Phe Ser Ala Phe Lys Pro
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20 25 30

Ser His Lys Arg Leu Arg Leu Ser Arg Arg Arg Arg Arg Thr Leu Ser Ser
35 40 45

His Cys Ser Leu Arg Gly Ser Thr Phe Gln Cys Leu Asp Pro Cys Asn
50 55 60

Gln Gln Arg Phe Leu Gly Asp Asn Gly Phe Ala Ser Leu Phe Gly Ser
65 70 75 80

Lys Pro Leu Arg Ser Asn Arg Gly His Leu Arg Leu Gly Arg Thr Ser
85 90 95

His Ser Gly Glu Val Met Ala Val Ala Met Gln Pro Ala Gln Glu Val
100 105 110

Ser Thr Asn Lys Lys Pro Ala Thr Lys Gln Arg Arg Val Val Val Thr
115 120 125

Gly Met Gly Val Val Thr Pro Leu Gly His Asp Pro Asp Val Tyr Tyr
130 135 140

Asn Asn Leu Leu Asp Gly Ile Ser Gly Ile Ser Glu Ile Glu Asn Phe
145 150 155 160

Asp Cys Ser Gln Phe Pro Thr Arg Ile Ala Gly Glu Ile Lys Ser Phe
165 170 175

Ser Thr Asp Gly Trp Val Ala Pro Lys Phe Ser Glu Arg Met Asp Lys
180 185 190

Phe Met Leu Tyr Met Leu Thr Ala Gly Lys Lys Ala Leu Ala Asp Gly
195 200 205

Gly Ile Thr Glu Asp Ala Met Lys Glu Leu Asn Lys Arg Lys Cys Gly
210 215 220

Val Leu Ile Gly Ser Gly Leu Gly Gly Met Lys Val Phe Ser Asp Ser
225 230 235 240

Ile Glu Ala Leu Arg Thr Ser Tyr Lys Lys Ile Ser Pro Phe Cys Val
245 250 255

Pro Phe Ser Thr Thr Asn Met Gly Ser Ala Ile Leu Ala Met Asp Leu
260 265 270

Gly Trp Met Gly Pro Asn Tyr Ser Ile Ser Thr Ala Cys Ala Thr Ser
275 280 285

Asn Phe Cys Ile Leu Asn Ala Ala Asn His Ile Ile Lys Gly Glu Ala
290 295 300

Asp Met Met Leu Cys Gly Gly Ser Asp Ala Ala Val Leu Pro Val Gly
305 310 315 320

Leu Gly Gly Phe Val Ala Cys Arg Ala Leu Ser Gln Arg Asn Asn Asp
325 330 335

Pro Thr Lys Ala Ser Arg Pro Trp Asp Ser Asn Arg Asp Gly Phe Val
340 345 350

Met Gly Glu Gly Ala Gly Val Leu Leu Leu Glu Glu Leu Glu His Ala
355 360 365

Lys Lys Arg Gly Ala Thr Ile Tyr Ala Glu Phe Leu Gly Gly Ser Phe
370 375 380

Thr Cys Asp Ala Tyr His Met Thr Glu Pro His Pro Glu Gly Ala Gly
385 390 395 400

Val Ile Leu Cys Ile Glu Lys Ala Leu Ala Gln Ser Gly Val Ser Arg
405 410 415

Glu Asp Val Asn Tyr Ile Asn Ala His Ala Thr Ser Thr Pro Ala Gly
420 425 430

Asp Ile Lys Glu Tyr Gln Ala Leu Ala His Cys Phe Gly Gln Asn Ser
435 440 445

Glu Leu Arg Val Asn Ser Thr Lys Ser Met Ile Gly His Leu Leu Gly
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Gly Ala Gly Gly Val Glu Ala Val Ala Val Val Gln Ala Ile Arg Thr
465 470 475 480

Gly Trp Ile His Pro Asn Ile Asn Leu Glu Asp Pro Asp Glu Gly Val
485 490 495

Asp Ala Lys Leu Leu Val Gly Pro Lys Lys Glu Lys Leu Lys Val Lys
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Val Gly Ieu Ser Asn Ser Phe Gly Phe Gly Gly His Asn Ser Ser Ile
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Leu Phe Ala Pro Cys Asn
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<213> Cuphea hookeriana

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Leu	Leu	Asp	Gly	Thr	Ser	Gly	Ile	Ser	Glu	Ile	Glu	Thr	Phe	Asp	Cys
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Ala	Gln	Phe	Pro	Thr	Arg	Ile	Ala	Gly	Glu	Ile	Lys	Ser	Phe	Ser	Thr
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Asp Gly Trp Val Ala Pro Lys Leu Ser Lys Arg Met Asp Lys Phe Met
65 70 75 80

Leu Tyr Met Leu Thr Ala Gly Lys Lys Ala Leu Thr Asn Gly Gly Ile
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Thr Glu Asp Val Met Lys Glu Leu Asp Lys Arg Lys Cys Gly Val Leu
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Ile Gly Ser Ala Met Gly Gly Met Lys Val Phe Asn Asp Ala Ile Glu
115 120 125

Ala Leu Arg Ile Ser Tyr Lys Lys Met Asn Pro Phe Cys Val Pro Phe
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Ala Thr Thr Asn Met Gly Ser Ala Met Leu Ala Met Asp Leu Gly Trp
145 150 155 160

Met Gly Pro Asn Tyr Ser Ile Ser Thr Ala Cys Ala Thr Ser Asn Phe
165 170 175

Cys Ile Leu Asn Ala Ala Asn His^bIle Ile Arg Gly Glu Ala Asp Val
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Met Leu Cys Gly Gly Ser Asp Ala Val Ile Ile Pro Ile Gly Met Gly
195 200 205

Gly Phe Val Ala Cys Arg Ala Leu Ser Gln Arg Asn Ala Asp Pro Thr
210 215 220

Lys Ala Ser Arg Pro Trp Asp Ser Asn Arg Asp Gly Phe Val Met Gly
225 230 235 240

Glu Gly Ala Gly Val Leu Leu Leu Glu Glu Leu Glu His Ala Lys Lys
245 250 255

Arg Gly Ala Thr Ile Tyr Ala Glu Phe Leu Gly Gly Ser Phe Thr Cys
260 265 270

Asp Ala Tyr His Met Thr Glu Pro His Pro Asp Gly Ala Gly Val Ile
275 280 285

Leu Cys Ile Glu Lys Ala Leu Ala Gln Ser Gly Val Ser Arg Glu Asp
290 295 300

Val Asn Tyr Ile Asn Ala His Ala Thr Ser Thr Pro Ala Gly Asp Ile
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Lys Glu Tyr Gln Ala Leu Ile His Cys Phe Gly Gln Asn Asn Glu Leu
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Lys Val Asn Ser Thr Lys Ser Met Ile Gly His Leu Leu Gly Ala Ala
340 345 350

Gly Gly Val Glu Ala Val Ser Val Val Gln Ala Ile Arg Thr Gly Trp
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Ile His Pro Asn Ile Asn Leu Glu Asn Pro Asp Glu Gly Val Asp Thr
370 375 380

Lys Leu Leu Val Gly Pro Lys Lys Glu Arg Leu Asn Ile Lys Val Gly
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Ala Pro Tyr Asn
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 <212> PRT
 <213> Cuphea pulcherrima

<400> 10

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Phe Arg Pro Lys Ser Ser Thr Val Arg Pro Leu His Arg Ala Ser Ile

20

25

30

Pro Asn Val Arg Ala Ala Ser Pro Thr Val Ser Ala Pro Lys Arg Glu
35 40 45

Thr Asp Pro Lys Lys Arg Val Val Ile Thr Gly Met Gly Leu Val Ser
50 55 60

Val Phe Gly Ser Asp Val Asp Ala Tyr Tyr Asp Lys Leu Leu Ser Gly
65 70 75 80

Glu Ser Gly Ile Gly Pro Ile Asp Arg Phe Asp Ala Ser Lys Phe Pro
85 90 95

Thr Arg Phe Gly Gly Gln Ile Arg Gly Phe Asn Ser Met Gly Tyr Ile
100 105 110

Asp Gly Lys Asn Asp Arg Arg Leu Asp Asp Cys Leu Arg Tyr Cys Ile
115 120 125

Val Ala Gly Lys Lys Ser Leu Glu Asp Ala Asp Leu Gly Ala Asp Arg
130 135 140

Leu Ser Lys Ile Asp Lys Glu Arg Ala Gly Val Leu Val Gly Thr Gly
145 150 155 160

Met Gly Gly Leu Thr Val Phe Ser Asp Gly Val Gln Ser Leu Ile Glu
165 170 175

Lys Gly His Arg Lys Ile Thr Pro Phe Phe Ile Pro Tyr Ala Ile Thr
180 185 190

Asn Met Gly Ser Ala Leu Leu Ala Ile Glu Leu Gly Leu Met Gly Pro
195 200 205

Asn Tyr Ser Ile Ser Thr Ala Cys Ala Thr Ser Asn Tyr Cys Phe His
210 215 220

Ala Ala Ala Asn His Ile Arg Arg Gly Glu Ala Asp Leu Met Ile Ala
225 230 235 240

Gly Gly Thr Glu Ala Ala Ile Ile Pro Ile Gly Leu Gly Gly Phe Val

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260	265	270	
Arg Pro Trp Asp Lys Asp Arg Asp Gly Phe Val Met Gly Glu Gly Ala			
275	280	285	
Gly Val Leu Val Leu Glu Ser Leu Glu His Ala Met Lys Arg Gly Ala			
290	295	300	
Pro Ile Ile Ala Glu Tyr Leu Gly Gly Ala Ile Asn Cys Asp Ala Tyr			
305	310	315	320
His Met Thr Asp Pro Arg Ala Asp Gly Leu Gly Val Ser Ser Cys Ile			
325	330	335	
Glu Ser Ser Leu Glu Asp Ala Gly Val Ser Pro Glu Glu Val Asn Tyr			
340	345	350	
Ile Asn Ala His Ala Thr Ser Thr Leu Ala Gly Asp Leu Ala Glu Ile			
355	360	365	
Asn Ala Ile Lys Lys Val Phe Lys Asn Thr Lys Asp Ile Lys Ile Asn			
370	375	380	
Ala Thr Lys Ser Met Ile Gly His Cys Leu Gly Ala Ser Gly Gly Leu			
385	390	395	400
Glu Ala Ile Ala Thr Ile Lys Gly Ile Asn Thr Gly Trp Leu His Pro			
405	410	415	
Ser Ile Asn Gln Phe Asn Pro Glu Pro Ser Val Glu Phe Asp Thr Val			
420	425	430	
Ala Asn Lys Lys Gln Gln His Glu Val Asn Val Ala Ile Ser Asn Ser			
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Phe Gly Phe Gly Gly His Asn Ser Val Val Ala Phe Ser Ala Phe Lys			
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Pro			
465			

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<211> 1802
<212> DNA
<213> Cuphea pulcherrima

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ct						1802

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 <212> PRT
 <213> Cuphea pulcherrima

<400> 12

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Phe	Arg	Leu	Asn	Ser	Pro	Ser	Ser	Ala	Ala	Ala	Leu	Arg	Pro	Leu	Arg
			20				25					30			

Arg	Ala	Ser	Leu	Pro	Val	Ile	Arg	Ala	Ala	Thr	Ala	Ser	Ala	Pro	Lys
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Arg	Glu	Ser	Asp	Pro	Lys	Lys	Arg	Val	Val	Ile	Thr	Gly	Met	Gly	Leu
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Val	Ser	Val	Phe	Gly	Ser	Asp	Val	Asp	Ala	Tyr	Tyr	Asp	Lys	Leu	Leu
					65			70		75		80			

Ser	Gly	Glu	Ser	Gly	Ile	Ser	Leu	Ile	Asp	Arg	Phe	Asp	Ala	Ser	Lys
					85			90			95				

Phe	Pro	Thr	Arg	Phe	Ala	Gly	Gln	Ile	Arg	Gly	Phe	Asn	Ala	Thr	Gly
					100			105			110				

Tyr	Ile	Asp	Gly	Lys	Asn	Asp	Arg	Arg	Leu	Asp	Asp	Cys	Leu	Arg	Tyr
					115			120			125				

Cys	Ile	Val	Ala	Gly	Lys	Lys	Ala	Leu	Glu	Asp	Ala	Asp	Leu	Ala	Gly
					130			135			140				

Gln Ser Leu Ser Lys Ile Asp Lys Glu Arg Ala Gly Val Leu Val Gly
145 150 155 160

Thr Gly Met Gly Gly Leu Thr Val Phe Ser Asp Gly Val Gln Asn Leu
165 170 175

Ile Glu Lys Gly His Arg Lys Ile Ser Pro Phe Ile Pro Tyr Ala
180 185 190

Ile Thr Asn Met Gly Ser Ala Leu Leu Ala Ile Asp Leu Gly Leu Met
195 200 205

Gly Pro Asn Tyr Ser Ile Ser Thr Ala Cys Ala Thr Ser Asn Tyr Cys
210 215 220

Phe Tyr Ala Ala Ala Asn His Ile Arg Arg Gly Glu Ala Asp Leu Met
225 230 235 240

Ile Ala Gly Gly Thr Glu Ala Ala Val Ile Pro Ile Gly Leu Gly Gly
245 250 255

Phe Val Ala Cys Arg Ala Leu Ser Gln Arg Asn Asp Asp Pro Gln Thr
260 265 270

Ala Ser Arg Pro Trp Asp Lys Asp Arg Asp Gly Phe Val Met Gly Glu
275 280 285

Gly Ala Gly Val Leu Val Met Glu Ser Leu Glu His Ala Met Lys Arg
290 295 300

Gly Ala Pro Ile Ile Ala Glu Tyr Leu Gly Gly Ala Val Asn Cys Asp
305 310 315 320

Ala Tyr His Met Thr Asp Pro Arg Ala Asp Gly Leu Gly Val Ser Ser
325 330 335

Cys Ile Glu Ser Ser Leu Glu Asp Ala Gly Val Ser Pro Glu Glu Val
340 345 350

Asn Tyr Ile Asn Ala His Ala Thr Ser Thr Leu Ala Gly Asp Leu Ala
355 360 365

Glu Ile Asn Ala Ile Lys Lys Val Phe Lys Asn Thr Lys Glu Ile Lys

370

375

380

Ile Asn Ala Thr Lys Ser Met Ile Glý His Cys Leu Gly Ala Ser Gly
385 390 395 400

Gly Leu Glu Ala Ile Ala Thr Ile Lys Gly Ile Thr Thr Gly Trp Leu
405 410 415

His Pro Ser Ile Asn Gln Phe Asn Pro Glu Pro Ser Val Asp Phe Asn
420 425 430

Thr Val Ala Asn Lys Lys Gln Gln His Glu Val Asn Val Ala Ile Ser
435 440 445

Asn Ser Phe Gly Phe Gly Gly His Asn Ser Val Val Ala Phe Ser Ala
450 455 460

Phe Lys Pro
465

<210> 13
<211> 2369
<212> DNA
<213> Cuphea pulcherrima

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 <212> PRT
 <213> Cuphea pulcherrima
 <400> 14

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Pro	Ser	Ile	Ser	Ser	Pro	Arg	Arg	Arg	Leu	Ser	Arg	Arg	Ile	Leu	
					35				40						45
Ser	Gln	Cys	Ala	Pro	Leu	Pro	Ser	Ala	Ser	Ser	Ala	Leu	Arg	Gly	Ser
					50				55						60
Ser	Phe	His	Thr	Leu	Val	Thr	Ser	Tyr	Leu	Ala	Cys	Phe	Glu	Pro	Cys
					65			70			75				80
His	Asp	Tyr	Tyr	Thr	Ser	Ala	Ser	Leu	Phe	Gly	Ser	Arg	Pro	Ile	Arg
					85				90						95
Thr	Thr	Arg	Arg	His	Arg	Arg	Leu	Asn	Arg	Ala	Ser	Pro	Ser	Arg	Glu
					100				105						110
Ala	Met	Ala	Val	Ala	Leu	Gln	Pro	Glu	Gln	Glu	Val	Thr	Thr	Lys	Lys
						115			120						125
Lys	Pro	Ser	Ile	Lys	Gln	Arg	Arg	Val	Val	Val	Thr	Gly	Met	Gly	Val
					130			135			140				
Val	Thr	Pro	Leu	Gly	His	Asp	Pro	Asp	Val	Phe	Tyr	Asn	Asn	Leu	Leu
						145			150			155			160
Asp	Gly	Thr	Ser	Gly	Ile	Ser	Glu	Ile	Glu	Thr	Phe	Asp	Cys	Ala	Gln
					165				170						175
Phe	Pro	Thr	Arg	Ile	Ala	Gly	Glu	Ile	Lys	Ser	Phe	Ser	Thr	Asp	Gly
					180				185						190
Trp	Val	Ala	Pro	Lys	Leu	Ser	Lys	Arg	Met	Asp	Lys	Phe	Met	Leu	Tyr

195

200

205

Met Leu Thr Ala Gly Lys Lys Ala Leu Thr Asp Gly Gly Ile Thr Glu
210 215 220

Asp Val Met Lys Glu Leu Asp Lys Arg Lys Cys Gly Val Leu Ile Gly
225 230 235 240

Ser Ala Met Gly Gly Met Lys Val Phe Asn Asp Ala Ile Glu Ala Leu
245 250 255

Arg Ile Ser Tyr Lys Lys Met Asn Pro Phe Cys Val Pro Phe Ala Thr
260 265 270

Thr Asn Met Gly Ser Ala Met Leu Ala Met Asp Leu Gly Trp Met Gly
275 280 285

Pro Asn Tyr Ser Ile Ser Thr Ala Cys Ala Thr Ser Asn Phe Cys Ile
290 295 300

Met Asn Ala Ala Asn His Ile Ile Arg Gly Glu Ala Asp Val Met Leu
305 310 315 320

Cys Gly Gly Ser Asp Ala Val Ile Ile Pro Ile Gly Met Gly Gly Phe
325 330 335

Val Ala Cys Arg Ala Leu Ser Gln Arg Asn Ser Asp Pro Thr Lys Ala
340 345 350

Ser Arg Pro Trp Asp Ser Asn Arg Asp Gly Phe Val Met Gly Glu Gly
355 360 365

Ala Gly Val Leu Leu Leu Glu Glu Leu Glu His Ala Lys Lys Arg Gly
370 375 380

Ala Thr Ile Tyr Ala Glu Phe Leu Gly Gly Ser Phe Thr Cys Asp Ala
385 390 395 400

Tyr His Met Thr Glu Pro His Pro Asp Gly Ala Gly Val Ile Leu Cys
405 410 415

Ile Glu Lys Ala Leu Ala Gln Ser Gly Val Ser Arg Glu Asp Val Asn
420 425 430

Tyr Ile Asn Ala His Ala Thr Ser Thr Pro Ala Gly Asp Ile Lys Glu
435 440 445

Tyr Gln Ala Leu Ile His Cys Phe Gly Gln Asn Arg Glu Leu Lys Val
450 455 460

Asn Ser Thr Lys Ser Met Ile Gly His Leu Leu Gly Ala Ala Gly Gly
465 470 475 480

Val Glu Ala Val Ser Val Val Gln Ala Ile Arg Thr Gly Trp Ile His
485 490 495

Pro Asn Ile Asn Leu Glu Asn Pro Asp Glu Gly Val Asp Thr Lys Leu
500 505 510

Leu Val Gly Pro Lys Lys Glu Arg Leu Asn Val Lys Val Gly Leu Ser
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Tyr Ile
545

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<223> unsure at all n locations

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<400> 17

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Phe Val Ser Lys Arg Val Phe Cys Cys Ser Ala Val Gln Asp Ser Asp			
35	40	45	

Arg Gln Ser Leu Gly Asp Ser Arg Ser Pro Arg Leu Val Ser Arg Gly			
50	55	60	

Cys Lys Leu Ile Gly Ser Gly Ser Ala Ile Pro Ala Leu Gln Val Ser			
65	70	75	80

Asn Asp Asp Leu Ala Lys Ile Val Asp Thr Asn Asp Glu Trp Ile Thr			
85	90	95	

Val Arg Thr Gly Ile Arg Asn Arg Arg Val Leu Ser Gly Lys Asp Ser

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Leu Thr Asn Leu Ala Ser Glu Ala Ala Arg Lys Ala Leu Glu Met Ala
115 120 125

Gln Val Asp Ala Asn Asp Val Asp Met Val Leu Met Cys Thr Ser Thr
130 135 140

Pro Glu Asp Leu Phe Gly Ser Ala Pro Gln Ile Ser Lys Ala Leu Gly
145 150 155 160

Cys Lys Lys Asn Pro Leu Ser Tyr Asp Ile Thr Ala Ala Cys Ser Gly
165 170 175

Phe Val Leu Gly Leu Val Ser Ala Ala Cys His Ile Arg Gly Gly Gly
180 185 190

Phe Asn Asn Ile Leu Val Ile Gly Ala Asp Ser Leu Ser Arg Tyr Val
195 200 205

Asp Trp Thr Asp Arg Gly Thr Cys Ile Leu Phe Gly Asp Ala Ala Gly
210 215 220

Ala Val Val Val Gln Ser Cys Asp Ala Glu Glu Asp Gly Leu Phe Ala
225 230 235 240

Phe Asp Leu His Ser Asp Gly Asp Gly Gln Arg His Leu Lys Ala Ala
245 250 255

Ile Lys Glu Asp Glu Val Asp Lys Ala Leu Gly His Asn Gly Ser Ile
260 265 270

Arg Asp Phe Pro Pro Arg Arg Ser Ser Tyr Ser Cys Ile Gln Met Asn
275 280 285

Gly Lys Glu Val Phe Arg Phe Ala Cys Arg Ser Val Pro Gln Ser Ile
290 295 300

Glu Ser Ala Leu Gly Lys Ala Gly Leu Asn Gly Ser Asn Ile Asp Trp
305 310 315 320

Leu Leu Leu His Gln Ala Asn Gln Arg Ile Ile Asp Ala Val Ala Thr
325 330 335

Arg Leu Glu Val Pro Gln Glu Arg Ile Ile Ser Asn Leu Ala Asn Tyr
340 345 350

Gly Asn Thr Ser Ala Ala Ser Ile Pro Leu Ala Leu Asp Glu Ala Val
355 360 365

Arg Ser Gly Asn Val Lys Pro Gly His Val Ile Ala Thr Ala Gly Phe
370 375 380

Gly Ala Gly Leu Thr Trp Gly Ser Ala Ile Ile Arg Trp Gly
385 390 395